As amended, all the pending claims of the subject application comply with all requirements of 35 U.S.C. Accordingly, Applicant requests examination and allowance of all pending claims.

The Examiner Interview - January 3, 2003

Applicants would like to thank the Examiner for the time he spent discussing this case by telephone on January 3, 2003. During the interview, Applicants summarized the invention and the state of the art and discussed the differences between the claims and the Lee et al. reference. It was also discussed that the pending claims were not amended in the first Response filed July 12, 2002 and that the current rejection of the claims is substantially the same as the initial rejection of the claims.

Applicants explained their position that Lee et al. does not anticipate any of the pending claims because the current rejection picks isolated elements from different embodiments disclosed in Lee et al. and combines them in an improper manner. For example, the rejection states that Example 1 in Lee et al. (col. 11, line 55 to col. 12, line 3) teaches the limitation of heating the substrate to a temperature above 450°C as recited in claim 1. While Example 1 in Lee et al. does indeed teach heating a substrate to a temperature above 450°C (see col. 11, line 66-67), the example is specifically limited to a thermal CVD process (see col. 11, line 58) and the claims of the present application require a plasma process.

At one point the Examiner indicated he believed that an anticipation rejection was proper as long as each of the claimed elements can be found anywhere within a single prior art reference. Applicants would like to remind the Examiner, however, that test for anticipation is more strict than that. Specifically, the Federal Circuit has ruled that it is not enough that a reference disclose all the claimed elements in isolation; instead a reference must disclose each element of the claimed invention "as arranged in the claim." *Lindermann v. American Hoist*, 730 F.2d 1452 (Fed. Cir. 1984) (emphasis added). The current rejection is faulty because individual elements of different embodiments disclosed in Lee et al. have been improperly combined in an attempt to find that Lee et al. anticipates many of the pending claims. For example, the invention of claim 1 pertains to:

(1) a plasma CVD process that deposits a silicon oxide layer at

(2) a substrate temperature of greater than 450°C using

(3) silicon, oxygen and fluorine gaseous sources.

In arguing claim 1 is anticipated, the Rejection relies on a thermal (not plasma) CVD example (Example 1) in Lee et al. to teach limitation (2). The rejection also relies on a portion of Lee et al. (col. 1, line 63) related to deposition of a silicon oxide layer to teach the silicon and oxygen gaseous sources of limitation (3) but relies on a portion of Lee et al. (col. 2, line 32) related to deposition of an amorphous carbon (not silicon oxide) layer to teach the fluorine gaseous source of limitation (3). Accordingly, Applicants respectfully assert that Lee et al. does not teach the invention as claimed in claim 1. Applicants also note that Lee et al. does not anticipate or make obvious any of the other claims for reasons already set forth in the Response mailed July 12, 2002.

Accordingly, reconsideration of the Rejection is respectfully requested. Also, if the Examiner believes an additional search is warranted and that a new ground of rejection is appropriate, Applicants respectfully request that a new, non-final Office Action be prepared. Applicants have not amended the claims in any manner since their initial Examination.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is urged. If the Examiner believes a telephone conference would aid in the prosecution of this case in any way, please call the undersigned at 650-326-2400.

Respectfully submitted,

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APPENDIX

IN THE CLAIMS:

Note that pending claims 1-41 remain unchanged, but are reproduced below for the Examiner's convenience and reference.

1. (Unchanged) A method for forming a silicon oxide layer over a substrate disposed in a high density plasma substrate processing chamber, said method comprising:

flowing a process gas into the substrate processing chamber, said process gas comprising a silicon-containing source, an oxygen-containing source and a fluorine-containing source;

forming a plasma from said process gas; and

heating the substrate to a temperature above 450°C during deposition of said silicon oxide layer.

2. (Unchanged) The method of claim 1 wherein the substrate is heated to a temperature above 500°C during deposition of said silicon oxide layer.

3. (Unchanged) The method of claim 1 wherein the substrate is maintained at a temperature between 500-600°C during deposition of said silicon oxide layer.

4. (Unchanged) The method of claim 1 wherein said silicon-containing gas is SiH_4.

5. (Unchanged) The method of claim 1 wherein said oxygen-containing source is O_2.

6. (Unchanged) The method of claim 1 wherein said silicon oxide layer has a fluorine content of less than 1.0 at. %.

7. (Unchanged) The method of claim 6 wherein said fluorine-containing source is either NF_3 or a fluorocarbon having a formula of C_nF_{2n+2} where n is a positive integer.

8. (Unchanged) The method of claim 7 wherein the plasma has an ion density of at least 1 H 10^{11} ions/cm^3.

9. (Unchanged) The method of claim 1 wherein a flow ratio of said oxygen-containing source to said silicon-containing source is between 1.4-3.0:1 inclusive.

10. (Unchanged) A method for forming a silicon oxide layer over a substrate disposed in a high density plasma substrate processing chamber, said method comprising:

(a) flowing a first gas into the substrate processing chamber;

(b) forming a plasma having an ion density of at least 1×10^{11} ions/cm^3 from said first gas and allowing said plasma to heat said substrate;

(c) thereafter, flowing a process gas comprising a silicon-containing source, an oxygen-containing source and a fluorine-containing source into said substrate processing chamber; and

(d) forming a plasma having an ion density of at least 1×10^{11} ions/cm^3 from said process gas and allowing said plasma to heat said substrate to a temperature at or above 450°C during deposition of said silicon oxide layer.

11. (Unchanged) The method of claim 10 wherein said oxygen-containing source is O_2 and said silicon-containing source is SiH_4.

12. (Unchanged) The method of claim 11 wherein said first gas comprises one or more of argon and O_2.

13. (Unchanged) The method of claim 10 wherein said fluorine-containing source is either NF_3 or a gas having the formula of C_nF_{2n+2} where n is a positive integer.

14. (Unchanged) The method of claim 13 wherein a flow ratio of said oxygen-containing source to said silicon-containing source is between 1.4-3.0:1 inclusive.

15. (Unchanged) The method of claim 10 wherein said silicon oxide layer has a fluorine content of less than 1.0 at. %.

16. (Unchanged) The method of claim 10 wherein in (d) said plasma heats said substrate to a temperature of 500°C or more.

17. (Unchanged) A method for forming a silicon oxide layer over a substrate disposed in a high density plasma substrate processing chamber, said method comprising:

(a) flowing a first gas comprising at least one of an inert gas and O_2 into the substrate processing chamber;

(b) forming a plasma having an ion density of at least 1×10^{11} ions/cm^3 from said first gas and allowing said plasma to heat said substrate;

(c) thereafter, depositing said silicon oxide layer by flowing a process gas comprising SiH_4, O_2 and a fluorine-containing source into said substrate processing chamber while maintaining said plasma and allowing said plasma to heat said substrate to a temperature above 450°C during deposition of said silicon oxide layer;

wherein said silicon oxide layer has a fluorine concentration of 1.0 at. % or less.

18. (Unchanged) The method of claim 17 wherein said silicon oxide layer has a fluorine content of 0.6 at. % or less.

19. (Unchanged) The method of claim 18 wherein a flow rate of said fluorine-containing source is greater than or equal to a flow rate of SiH_4.

20. (Unchanged) The method of claim 17 wherein said fluorine-containing source is NF_3.

21. (Unchanged) The method of claim 17 wherein said fluorine-containing source is a fluorocarbon having a formula of C_nF_{2n+2} where n is a positive integer.

22. (Unchanged) The method of claim 17 wherein a flow ratio of said oxygen-containing source to said silicon-containing source is between 1.6-2.5:1 inclusive.

23. (Unchanged) The method of claim 20 wherein a flow rate of NF_3 is between 50-150 sccm and a flow rate of SiH_4 is between 50-150 sccm.

24. (Unchanged) The method of claim 23 wherein a flow rate of NF_3 is greater than or equal to a flow rate of SiH_4.

25. (As Added) The method of claim 1 wherein the silicon oxide layer is used as a premetal dielectric layer or part of a shallow trench isolation structure.

26. (As Added) The method of claim 10 wherein the silicon oxide layer is used as a premetal dielectric layer or part of a shallow trench isolation structure.

27. (As Added) The method of claim 17 wherein the silicon oxide layer is used as a premetal dielectric layer or part of a shallow trench isolation structure.

28. (As Added) A method for forming a silicon oxide layer over a substrate disposed in a high density substrate processing chamber, said method comprising:

flowing a process gas a silicon-containing source, an oxygen-containing source and a fluorine-containing source into the substrate processing chamber;

forming a plasma having an ion density of at least 1×10^{11} ions/cm^3 from said process gas; and

biasing the plasma during deposition of the silicon oxide layer to generate a sputter etching component simultaneous with film deposition, wherein the plasma heats the substrate to a temperature at or above 500°C during deposition of the silicon oxide layer.

29. (As Added) The method of claim 28 wherein the sputtering element of the deposition process slows deposition on corners of raised surfaces the silicon oxide layer is deposited over thereby contributing to the increased gapfill capability of the silicon oxide layer.

30. (As Added) The method of claim 29 wherein the silicon oxide layer is used as a premetal dielectric layer or part of a shallow trench isolation structure.

31. (As Added) The method of claim 30 wherein said silicon oxide layer has a fluorine content of 0.6 at. % or less.

32. (As Added) The method of claim 31 wherein said silicon-containing gas is SiH_4.

33. (As Added) The method of claim 32 wherein said oxygen-containing source is O_2.

34. (As Added) The method of claim 1 wherein the silicon oxide layer is doped with phosphorus and said process gas further comprises a phosphorus-containing source.

35. (As Added) The method of claim 34 wherein said phosphorus-containing source is PH_3.

36. (As Added) The method of claim 10 wherein the silicon oxide layer is doped with phosphorus and said process gas further comprises a phosphorus-containing source.

37. (As Added) The method of claim 36 wherein said phosphorus-containing source is PH_3.

38. (As Added) The method of claim 18 wherein the silicon oxide layer is doped with phosphorus and said process gas further comprises a phosphorus-containing source.

39. (As Added) The method of claim 38 wherein said phosphorus-containing source is PH_3.

40. (As Added) The method of claim 31 wherein the silicon oxide layer is doped with phosphorus and said process gas further comprises a phosphorus-containing source.

41. (As Added) The method of claim 40 wherein said phosphorus-containing source is PH_3.